Strombolian eruptions produce gas-rich, magma-poor ejecta suggesting relatively large bubble rafts or individual 'slug' bubbles rise and burst. On ascent, small gas slugs can expand in equilibrium with the surrounding magma and maintain approximate magma-static pressure, but large gas slugs become dynamically overpressured in relation to the surrounding magma. In laboratory experiments, such unsteady flows of gas and liquid generate pressure changes measured in the ambient atmosphere above the upper liquid surface. These signals are accompanied by pressure changes in the experimental liquid and displacement of the experimental tube. We present experimental evidence of a range of burst processes that depend on the degree of gas overpressure in the slug. These processes range from the quiescent formation of a relatively long-lived liquid film, through complex transitional behaviour, to wholesale meniscus disruption when overpressure becomes appreciable. The style of pressure signals measured in the experimental atmosphere changes with the degree of overpressure, being predominantly driven by the two slug-depressurisation processes, namely (1) the rise of the liquid-atmosphere interface accompanying expansion, and (2) burst of the overpressured slug. The pressure fluctuations generated within the experimental liquid, and the forces applied to the experimental tube by both these pressure fluctuations and flow shear, give insight into the nature of seismic signals generated by the expansion and burst of gas slugs. We compare experimentally simulated results to existing acoustic and seismic measurements from a number of volcanic centres and discuss the insights this gives in interpretation of fluid-dynamic source mechanisms occurring during strombolian eruptions.